

Elasticity of Demand and Supply

Introduction and Description

Knowledge of price elasticity of demand and supply helps the students understand how businesses make pricing decisions and how governments make decisions on taxation. These exercises on elasticity become increasingly complex. To answer the elasticity questions on the AP Exam, the students should know the qualities that determine price elasticity of demand and supply, how the total revenue method can be used to determine price elasticity of demand and how to calculate elasticity coefficients. Elasticity lends itself to complex application questions. Knowledge of the factors that determine elasticity may be more important than memorizing formulas. The students should also have some knowledge of other elasticities including income elasticity of demand, cross elasticity of demand and elasticity of supply.

Objectives

1. Define *price elasticity of demand*.
2. Define *price elasticity of supply*.
3. Define and distinguish among *elastic*, *inelastic* and *unit elastic demand*.
4. Explain the characteristics that tend to make demand more elastic or more inelastic.
5. Determine the prices at which a product has elastic or inelastic demand by observing how total revenue changes in response to changes in price.
6. Apply price elasticity of demand to economic problems.
7. Define and distinguish between a *normal good* and an *inferior good* using income elasticity of demand.
8. Calculate price elasticities of demand using the arc method.
9. Calculate varying price elasticities of demand along a demand curve of constant shape.

Time Required

Three and one-half class periods or 158 minutes

Materials

1. Activities 17, 18, 19, 20 and 21
2. Visuals 2.7, 2.8, 2.9 and 2.10
3. Tennis ball and baseball
4. Paper clip
5. Rubber band

Procedure

1. Remind the students that as price decreases, quantity demanded increases. But does it increase a little or a lot? If it increases a lot, we call it *elastic*. If it increases a little, it is *inelastic*. Later we will define “a lot” and “a little.”
2. Illustrate this visually by dropping a tennis ball and a baseball. Elasticity is a measure of responsiveness to any stimulus. Dropping the ball is a stimulus just like a price change is a stimulus. A tennis ball bounces a lot. It is elastic. The baseball doesn’t bounce much. It is inelastic. Price elasticity of demand is the response of quantity demanded to a change in price.
3. Using Visual 2.7, give a lecture on the qualities that make demand elastic or inelastic.
 - (A) *Substitutability*. The more substitutes there are for the good, the greater the price elasticity of demand.
 - (B) *Proportion of income spent on product*. Low-priced goods, which require only a small portion of one’s income, tend to be more inelastic than high-priced goods, which require a large portion of one’s income.
 - (C) *Luxury or necessity*. Luxuries tend to be elastic while necessities tend to be inelastic.
 - (D) *Is it habit-forming?* Habit-forming goods

such as cigarettes, alcohol and drugs have more inelastic demand curves.

- (E) *Time.* Consumers can respond to a price change more easily if they have more time. The greater the period of time, the greater the price elasticity of demand.

4. Now it is time to put some numbers on “a lot” and “a little.” Use Visual 2.8 to explain how to calculate an elasticity coefficient. Make sure the students understand what the coefficients mean.
5. Have the students complete Activity 17 and discuss it. They may need help as they plow through the formulas. You might go over the first two problems before they finish the rest of the activity.
6. Have the students complete Activity 18, which expands upon Visual 2.7. You should also reinforce the concept of income elasticity of demand before the students begin the problem sheet. Income elasticity of demand is the ratio of the percentage change in quantity demanded of a good to the percentage change in income. It measures the responsiveness of consumer expenditures to changes in income. This is important to understand the concept of normal, luxury and inferior goods.
7. Discuss Activity 18.
8. Give a lecture on the total revenue test for price elasticity of demand. Because the relationship between price and quantity demanded is inverse, a total revenue test can be used to determine the price elasticity of demand:
$$\text{Price} \times \text{quantity} = \text{total revenue}$$
 - (A) If total revenue moves in the same direction as price, demand is price inelastic.
 - (B) If total revenue moves in the same direction as quantity or inversely to price, demand is price elastic.
 - (C) If total revenue remains the same as price increases, the demand is unit elastic.

This is a shortcut way to determine price elasticity of demand and for the students to check if their calculations of price elasticity of demand are at least in the right ballpark.

9. The total revenue test itself is not a very intuitive concept, and the students sometimes have difficulty remembering it. Try this demonstration to explain the concept: Holding a rubber band vertically, consider its top to be price and the bottom total revenue. Note that as you stretch the rubber band, price goes up while total revenue goes down. As you let go, price comes back down and total revenue goes up. They move in opposite directions (inversely), and a rubber band is *elastic*. Now hold a paper clip vertically and label the top price and the bottom total revenue. Note that as the top (price) goes up, so does the bottom (total revenue) of the paper clip. As the top goes down, so does the bottom. They move in the same direction (directly), and a paper clip is *inelastic*. Once the students have the big point about elasticity, it is important that they do not get the impression that the entire market curve for most products can be labeled elastic or inelastic. For most demand curves, elasticity varies at different points on the curve: more elastic at high prices and low quantities and more inelastic at low prices and high quantities. Visual 2.9 summarizes the relationship between elasticity and total revenue.
10. Have the students complete Activity 19 and discuss it.
11. Now it is time to apply elasticity to real-world examples. Have the students complete Activity 20 and discuss it.
12. Use Activity 21 to show how price elasticity of demand can be used to examine an economic policy question: Who really pays a tax? This activity also combines shifts and elasticity in supply and demand. Before beginning the activity, use Visual 2.10 to discuss tax incidence. Cover these points:

- (A) Often the person who actually pays the government does not bear the burden of the tax. The person who bears the burden of the tax is said to bear the *incidence* of the tax.
 - (B) Taxpayers will shift the incidence of a tax whenever possible.
 - (C) The incidence of a tax can be shifted only when the taxpayer can get a higher price for something he or she sells or a lower price for something he or she buys.
 - (D) If the taxpayer is able to raise the price of something he or she sells, the tax is shifted forward. If the taxpayer is able to lower the price of something he or she buys, the tax is shifted backward.
 - (E) How much of the incidence of a tax can be shifted depends on the elasticity of the supply and demand curves. The incidence is heaviest on the most inelastic curve.
- 13. Now have the students review Activity 21. This problem is an application of the supply and demand model. Actual numbers are supplied so that the students can get practice in interpreting diagrams for quantity and revenue implications as well as for equilibrium prices. Excise taxes can be analyzed by shifting either the supply or demand curve (but only one) by the amount of the tax.
 - 14. Have the students do page 1 of Activity 21 to make sure they know how to analyze data.
 - 15. Go over page 1 of Activity 21.
 - 16. Have the students complete the problem.
 - 17. Discuss the answers. You can make transparencies of the graphs in the answers and illustrate the three cases by coloring in different rectangles as the answers are developed.

Elasticity: An Introduction

Part A

Extra-Credit Problems

1. Now, suppose that your economics teacher currently allows you to earn extra credit by submitting answers to the end-of-the-chapter questions in your textbook. The number of questions you're willing to submit depends on the amount of extra credit for each question. How responsive you are to a change in the extra-credit points the teacher gives can be represented as an *elasticity*. Write the formula for the elasticity of extra-credit problems submitted:

$$\epsilon_{ps} = \frac{\text{percentage change in number of questions}}{\text{percentage change in extra-credit points}}$$

2. Now, consider that your teacher's goal is to get you to submit twice as many questions: a 100-percent increase. Underline the correct answer in parentheses.
 - (A) If the number of chapter-end questions you submit *is* very responsive to a change in extra-credit points, then a given increase in extra credit elicits a large increase in questions submitted. In this case, your teacher will need to increase the extra-credit points by (*more than* / *less than* / *exactly*) 100 percent.
 - (B) If the number of chapter-end questions you submit *is not* very responsive to a change in extra-credit points, then a given increase in extra credit elicits a small increase in questions submitted. In this case, your teacher will need to increase the extra-credit points by (*more than* / *less than* / *exactly*) 100 percent.

Part D

Coffee Problems

Suppose Moonbucks, a national coffee-house franchise, finally moves into the little town of Middle-of-nowhere. Moonbucks is the only supplier of coffee in town and faces the following demand schedule each week. Write the correct answer on the answer blanks, or underline the correct answer in parentheses.



Figure 17.3

Cups of Coffee Demanded per Week

Price (per cup)	Quantity Demanded
\$6	80
5	100
4	120
3	140
2	160
1	180
0	200

3. What is the arc price elasticity of demand when the price changes from \$1 to \$2? .18

$$\epsilon_d = \frac{\frac{\Delta Q}{(Q + Q_1) / 2}}{\frac{\Delta P}{(P + P_1) / 2}} = \frac{\frac{20}{170}}{\frac{1}{1.5}} = \frac{.12}{.67}$$

So, over this range of prices, demand is (*elastic* / *unit elastic* / *inelastic*).

4. What is the arc price elasticity of demand when the price changes from \$5 to \$6? 1.22

$$\epsilon_d = \frac{\frac{\Delta Q}{(Q + Q_1) / 2}}{\frac{\Delta P}{(P + P_1) / 2}} = \frac{\frac{20}{90}}{\frac{1}{5.5}} = \frac{.22}{.18}$$

So, over this range of prices, demand is (*elastic* / *unit elastic* / *inelastic*).

Note: Because the relationship between quantity demanded and price is inverse, price elasticity of demand would always be negative. Economists believe using negative numbers is confusing when referring to “large” or “small” elasticities of demand. Therefore, they use absolute or positive numbers, changing the sign on the negative numbers.

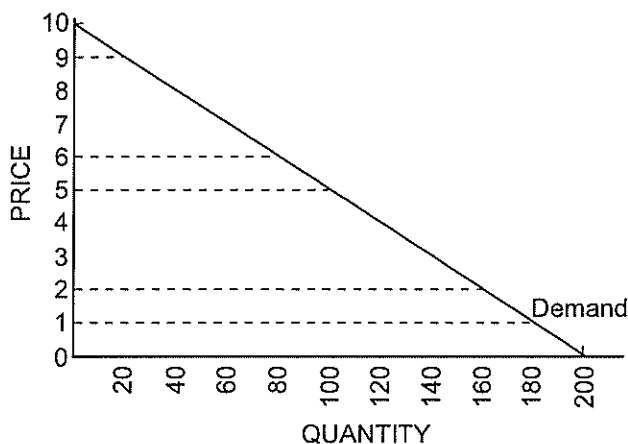
Part E

Now, consider Figure 17.4, which graphs the demand schedule given in Figure 17.3.

Recall the slope of a line is measured by the rise over the run: slope = rise / run = $\Delta P / \Delta Q$.



Figure 17.4

Elasticity of Demand for Coffee

5. Using your calculations of ΔP and ΔQ from Question 3, calculate the slope of the demand curve.
1/20 or .05
6. Using your calculations of ΔP and ΔQ from Question 4, calculate the slope of the demand curve.
1/20 or .05 This is the same slope as for Question 5. These calculations help the students to understand in Question 7 that a demand curve of constant slope has several varying elasticities.
7. The law of demand tells us that an increase in price results in a decrease in the quantity demanded. Questions 5 and 6 remind us that the slope of a straight line is *constant everywhere along the line*. Along this demand curve, a change in price of \$1 generates a change in quantity demanded of 20 cups of coffee a week.

You've now shown mathematically that while the slope of the demand curve is related to elasticity, the two concepts are not the same thing. Briefly discuss the relationship between where you are along the demand curve and the elasticity of demand. How does this tie into the notion of *responsiveness*? *At a higher price, you are in the price elastic portion of the demand curve. As you move to a lower price along a demand curve, the demand curve becomes more price inelastic. Thus, at a high price, a small percentage change in price leads to a large percentage change in quantity. As the price decreases, the same percentage change in price generates a smaller percentage change in quantity, so the elasticity of demand decreases.*

The Determinants of Elasticity of Demand

Suppose we don't know the precise demand schedule for electricity and there is a 20 percent increase in the price of a kilowatt hour of electricity. We know that quantity demanded will decrease, but will it be by less than 20 percent (inelastic demand), exactly 20 percent (unit elastic) or more than 20 percent (elastic demand)? What factors influence the price elasticity of demand? (Remember, *ceteris paribus*!)

Part A

Consider the following representative households in our market for electricity:

Household A: Uses electricity for lighting, appliances and heating.

Household B: Uses electricity for lighting, appliances and heating. Has a heating system that can, with one day's labor, be switched to burn natural gas.

1. Household B will have the more elastic demand because of the presence of a substitute good.
2. Because Household A has no available substitutes, should we assume that the quantity demanded of electricity will remain unchanged given the increase in price? No
Do you think Household A's response will be elastic or inelastic? Inelastic
3. Illustrate the same concept identified above by placing a 1, 2 or 3 by each item below, denoting the least price elastic to the most price elastic. Explain your reasoning.
1 Demand for insulin
3 Demand for Granny Smith apples
2 Demand for running shoes

Rationale: *The smaller the number of substitute goods, the less elastic is the demand for that good. Insulin has no substitutes. There are more substitutes for Granny Smith apples than for running shoes because Granny Smith is a particular type of apple, and running shoes include all running shoes. This is why the demand for Granny Smith apples is most elastic.*

4. To summarize: Demand is (more / less) elastic for goods with many available substitutes.

Part B

Consider the following representative households in the electricity market:

Household A: Currently spends \$300 a month on electricity.
The household income is \$1,200 per month.

Household B: Currently spends \$300 a month on electricity.
The household income is \$3,600 a month.

5. Household A will have the more-elastic demand, as the expenditures on this good account for a (*smaller / larger*) proportion of its income.
6. Illustrate the same concept identified above by placing a 1, 2 or 3 by each item below, denoting the least elastic to the most elastic. Explain your reasoning.
- 1 Demand for chewing gum
- 3 Demand for automobiles
- 2 Demand for clothing
- Rationale: *Autos take the largest proportion of income, then clothing, then chewing gum.*
7. To summarize: Goods that command a (*small / large*) proportion of a consumer's income tend to be more price elastic.

Part C

We expect that the price elasticity of demand will also vary with the nature of the good being considered. Is it a necessity? A durable good? Are we considering the short run or the long run? Consider the following alternatives, and underline the option that correctly completes each statement.

8. The price elasticity of demand for cigarettes: A product that is considered to be a necessity will have a relatively price (*elastic / inelastic*) demand.
9. The price elasticity of demand for automobiles: In the short run, consumers can postpone the purchase of durable goods, and so such goods will have a relatively price (*elastic / inelastic*) demand.
10. Briefly summarize how the nature of the good — necessity, durable good or luxury good — and the time frame affect the price elasticity of demand for electricity.
Goods that are necessary are less elastic than goods with many substitutes or that are luxuries. The longer the time frame, the more elastic is the demand for electricity.

Part D

Now, suppose that prices in the market for electricity remain constant, but consumers' income increases by 30 percent. Again, we may not know the precise demand schedule but may still be able to use notions of elasticity to speculate about what will happen to demand.

Recall the income elasticity of demand, ϵ_d :

$$\epsilon_d = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in income}}$$

Note in this case, income and quantity demanded are the relevant variables. All other variables, including the price of electricity, are held constant.

11. In measurements of elasticity, if income and quantity demanded move in the opposite direction — that is, if one increases while the other decreases — then the elasticity coefficient will be (*positive* / *negative*).
12. Remember that if income increases, the demand for a normal good increases and demand for an inferior good decreases. If the good is a normal good, income elasticity will be (*negative* / *positive*). If it is an inferior good, income elasticity will be (*negative* / *positive*).

Note: The formula in almost all principles of economics texts uses “quantity demanded” for income elasticity of demand. However, in the case of income elasticity of demand, the demand curve actually shifts. This can be confusing to the students because we make a big deal out of differentiating a change in quantity demanded from a change in demand. Make sure the students understand that the relationship is between a change of income and the amount of a good or service that buyers are willing to buy.

Elasticity and Total Revenue

Consider the following: total revenue (TR) = price (P) x quantity demanded (Q_d).

The responsiveness of quantity demanded to changes in price will determine whether a price increase leads to an increase or decrease in the total revenue generated.

The law of demand tells us that a price increase (decrease) will result in a decrease (increase) in quantity demanded: They move in opposite directions. What happens to TR when price changes is determined by the dominant effect, either the price effect or the quantity effect. In this case, knowing the price elasticity of demand solves the problem.

Consider that

- $\epsilon_d < 1 \Rightarrow \% \Delta \text{ in } Q_d < \% \Delta \text{ in price} \Rightarrow$ The *price effect* dominates.
 If price is increasing ($Q_d \downarrow$ by less), TR will increase.
 If price is decreasing ($Q_d \uparrow$ by less), TR will decrease.
- $\epsilon_d = 1 \Rightarrow \% \Delta \text{ in } Q_d = \% \Delta \text{ in price} \Rightarrow$ Neither effect dominates. TR remains unchanged.
- $\epsilon_d > 1 \Rightarrow \% \Delta \text{ in } Q_d > \% \Delta \text{ in price} \Rightarrow$ The *quantity effect* dominates.
 If price is increasing ($Q_d \downarrow$ by more), TR will decrease.
 If price is decreasing ($Q_d \uparrow$ by more), TR will increase.

Use this information to do the problems below. Fill in the blank or underline the correct answer.

1. Price rises from $P = \$5$ to $P_1 = \$6$, and quantity demanded decreases from $Q = 15$ to $Q_1 = 10$.

(A) The coefficient of elasticity equals 2.2.

(B) $P \quad x \quad Q \quad = \quad TR$
5 x 15 $=$ 75

(C) $P_1 \quad x \quad Q_1 \quad = \quad TR_1$
6 x 10 $=$ 60

(D) $P (\downarrow / \uparrow)$; $TR (\downarrow / \uparrow)$ Demand is (elastic / unit elastic / inelastic).

2. Price decreases from $P = \$10$ to $P_1 = \$9$, and quantity demanded increases from $Q = 100$ to $Q_1 = 110$.

(A) The coefficient of elasticity equals .91.

(B) $P \quad x \quad Q \quad = \quad TR$
10 x 100 $=$ 1,000

(C) $P_1 \quad x \quad Q_1 \quad = \quad TR_1$
9 x 110 $=$ 990

(D) $P (\downarrow / \uparrow)$; $(TR \downarrow / \uparrow)$ Demand is (elastic / unit elastic / inelastic).

Applying Elasticity to the Real World

Each of the following stories contains an assumption about elasticity of demand. In (A) for each story, decide whether the person's conclusion is right or wrong. In (B) explain your reasoning.

1. I.M. Politico, a candidate for the state legislature, is proposing a large increase in the tax on cigarettes and liquor. He says, "I'm not proposing these taxes to raise revenue but to discourage reckless drinking and the filthy smoking habit. If the prices of cigarettes and liquor go up, most people will quit using them. After all, no one needs to drink or smoke."
(A) *I.M. is wrong.*
(B) *He assumes that demand for these products is elastic, but it is not. He therefore falsely concludes that a tax increase on cigarettes and liquor will curb their consumption a great deal. In fact, taxes on these commodities will curb their consumption very little.*
2. U.R. Kool, a candidate for Congress, proposes freezing the price of gasoline. "There is no substitute for gasoline," he says. "People have to get from one place to another. Economists who say higher prices will discourage people from buying as much gas as before don't live in the real world."
(A) *U.R. is wrong.*
(B) *There are many methods of saving gasoline, including driving cars with smaller engines, car pooling and using public transportation. In fact, following the huge increases in the price of gasoline after 1973, people conserved on the use of gas, and sales were lower than they would have been if prices had not risen.*
3. Councilman Vic Acqua opposed a price increase for water during a recent drought. He claimed that there is no substitute for water. He believes an increase in the price of water (water taxes) will result in the same quantity of water used as before the price went up.
(A) *Vic is wrong.*
(B) *Demand for water is inelastic, but raising its price will curb consumption somewhat.*
4. Sky King, world traveler, says if the airlines want to increase total revenue, they should lower fares for business travelers as well as for vacationers. Both groups should respond equally to a price decrease.
(A) *Sky is wrong.*
(B) *He assumes that both business travelers and vacationers have an elastic demand for air travel. Business travelers' demand for air travel is inelastic because they cannot as easily postpone or give up their air travel. Vacationers can postpone their air travel, use other means of transportation or change their destination so as not to require air travel or to require less of it.*

Excise Taxes

Suppose Figures 21.1 and 21.2 show the current supply of Greebes.



Figure 21.1

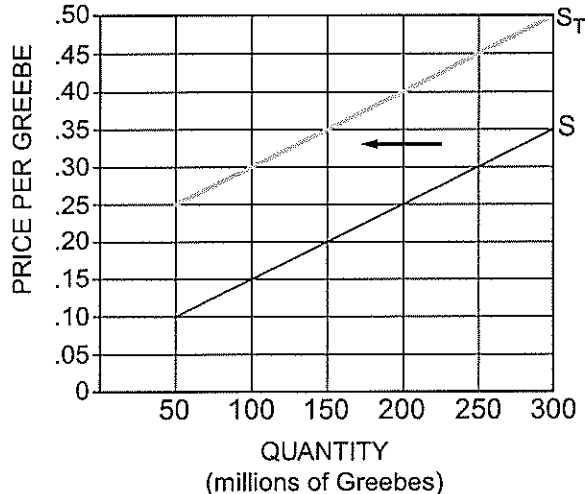
Table of Current Supply Schedule of Greebes

Quantity (millions)	Supply Price Before Tax (\$ per Greebe)	Supply Price After Tax (\$ per Greebe)
50	\$.10	.25
100	.15	.30
150	.20	.35
200	.25	.40
250	.30	.45
300	.35	.50



Figure 21.2

Current Supply Schedule of Greebes



Now, suppose that (to raise revenue for higher education) the government enacts an excise (sales) tax of \$0.15 per Greebe. *This tax will result in a new supply curve for Greebes.* To determine where this new supply curve lies, reason as follows: If before the tax, firms were willing to supply 50 million Greebes at a price of \$0.10, they would now be willing to supply 50 million Greebes only if the price were \$0.25. (Remember: \$0.15 of the price of each Greebe sold is now going to go to the government. So, if the price is \$0.25 and the government is getting \$0.15 of this price, then the seller is receiving the remaining \$0.10.)

Fill in the blank spaces in the table, and draw in the new supply curve that results from the tax. Label the new supply curve S_T .

What will be the result of this excise (sales) tax on the equilibrium quantity of Greebes? The equilibrium price paid by buyers (P_B)? The equilibrium price received by sellers (P_S)? The revenue received by the government? The income, or revenue, received by sellers after the tax?

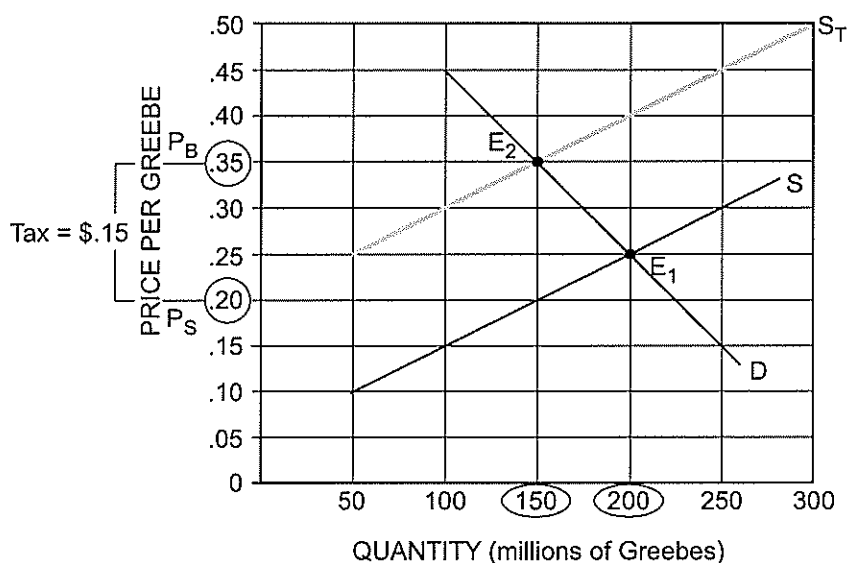
The answers to these important questions will depend on the nature of the demand for Greebes. The next section of this activity will help you determine the effects of a \$0.15 excise tax on Greebes under four different demand conditions.

Part A



Figure 21.3

Relatively Inelastic Demand for Greebes as Compared with D_1 on Figure 21.4



- On Figure 21.3 above, the equilibrium quantity of Greebes is 200 million Greebes. Q_{E1}
- On Figure 21.3, the equilibrium price of Greebes is \$0.25 per Greebe. P_{E1}
- Buyers are spending a total of \$50 million on Greebes. ($.25 \times 200 = \50)
- Sellers are receiving a total of \$50 million from selling Greebes. ($.25 \times 200 = \$50$)
- If an excise tax of \$0.15 for each Greebe sold is levied on the sellers of Greebes, the equilibrium price paid by buyers (P_B) will differ from the equilibrium price received by sellers (P_S) by the amount of the tax. Add the new supply curve incorporating the tax to the graph and indicate P_B and P_S . This \$0.15 goes to the government. Under these circumstances:
 - The new equilibrium quantity of Greebes would be 150 million. Q_{E2}
 - The new equilibrium price paid by buyers would be \$0.35 per Greebe. ($P_B = P_{E2}$)

(C) The new equilibrium price received by sellers (after tax) would be \$0.20 per Greebe.
($P_S = P_B - \text{TAX}$ or $\$0.35 - \$0.15 = \$0.20$)

(D) Buyers would spend a total of \$52.5 million on Greebes.
($P_B \times 150 = \$0.35 \times 150$)

(E) Sellers would receive a total of \$30 million (after tax) from selling Greebes.
($P_S \times 150 = \$0.20 \times 150$)

(F) The government revenue from this tax would be \$22.5 million.
($\text{TAX} \times 150 = \0.15×150)

(G) \$15 million of this revenue would be paid by buyers in the form of higher prices.
This is calculated by the equilibrium quantity times the difference in ($P_B - E_1$).
($P_B - P_{E1} \times 150 = (\$0.35 - \$0.25) \times 150 = \0.10×150)

(H) \$7.5 million of this revenue would be paid by sellers in the form of reduced income.
($P_{E1} - P_S \times 150 = (\$0.25 - \$0.20) \times 150 = \0.05×150)

(I) As a result of the tax, buyers will buy a smaller quantity than before the tax. If so, the sellers would also have a loss of revenue that is not collected by the government. In this case, the *uncollected revenue loss* would be equal to \$12.5 million.

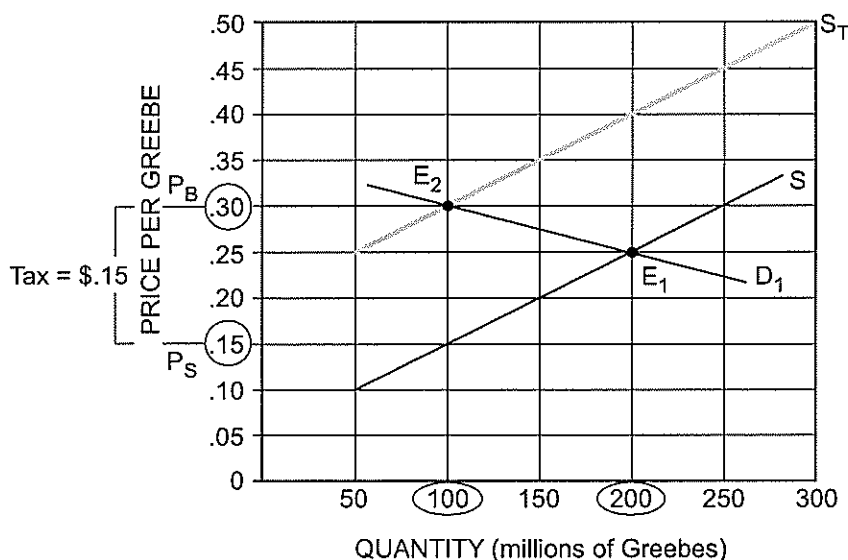
$$\begin{aligned} (200 - 150) \times \$0.25 &= 50 \times \$0.25 = \$12.5 \text{ or } \$50 \quad (4) \\ &\quad -30 \quad (5E) \\ &\quad 20 \\ &\quad -7.5 \quad (5H) \\ &\quad \$12.5 \end{aligned}$$

Part B



Figure 21.4

Relatively Elastic Demand for Greebes as Compared with D in Figure 21.3



6. On Figure 21.4, the equilibrium quantity of Greebes is 200 million. Q_{E1}
7. On Figure 21.4, the equilibrium price of Greebes is \$0.25 per Greebe. P_{E1}
8. Buyers are spending a total of \$50 million on Greebes. ($\$0.25 \times 200 = \50)
9. Sellers are receiving a total of \$50 million from selling Greebes. ($\$0.25 \times 200 = \50)
10. If an excise tax of \$0.15 for each Greebe sold is levied on the sellers of Greebes, the equilibrium price paid by buyers (P_B) will differ from the equilibrium price received by sellers (P_S) by the amount of the tax. This \$0.15 goes to the government. Add the new supply curve incorporating the tax to the graph, and indicate P_B and P_S . Under these circumstances:
 - (A) The new equilibrium quantity of Greebes would be 100 million. Q_{E2}
 - (B) The new equilibrium price paid by buyers would be \$0.30 per Greebe. ($P_B = P_{E2}$)
 - (C) The new equilibrium price received by sellers (after tax) would be \$0.15 per Greebe.
($P_S = P_B - TAX$ or $\$0.30 - \$0.15 = \$0.15$)
 - (D) Buyers would spend a total of \$30 million on Greebes.
($P_B \times 100 = \$0.30 \times 100 = \30)
 - (E) Sellers would receive a total of \$15 million (after tax) from selling Greebes.
($P_S \times 100 = \$0.15 \times 100 = \15)
 - (F) The government revenue from this tax would be \$15 million.
($TAX \times 100 = \$0.15 \times 100$)
 - (G) \$5 million of this revenue would be paid by buyers in the form of higher prices.
($P_B - P_{E1} \times 100 = (\$0.30 - \$0.25) \times 100 = \$0.05 \times 100 = \$5$)
 - (H) \$10 million of this revenue would be paid by sellers in the form of reduced income.
($P_{E1} - P_S \times 100 = (\$0.25 - \$0.15) \times 100 = \$0.10 \times 100 = \$10$)
 - (I) As a result of the tax, buyers will buy a smaller quantity than before the tax. If so, the sellers would also have a loss of revenue that is not collected by the government. In this case, the *uncollected revenue loss* would be equal to \$25 million.

$$(200 - 100) \times \$0.25 = 100 \times \$0.25 = \$25 \text{ or } \$50 \text{ (4)}$$

$$\underline{-15} \text{ (5E)}$$

$$35$$

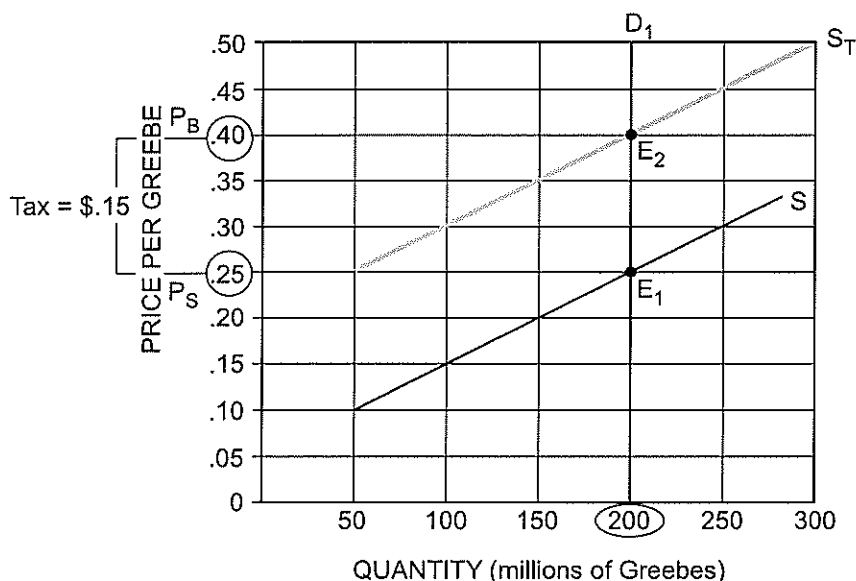
$$\underline{-10} \text{ (5H)}$$

$$\$25$$

Part C



Figure 21.5
Perfectly Inelastic Demand for Greebes



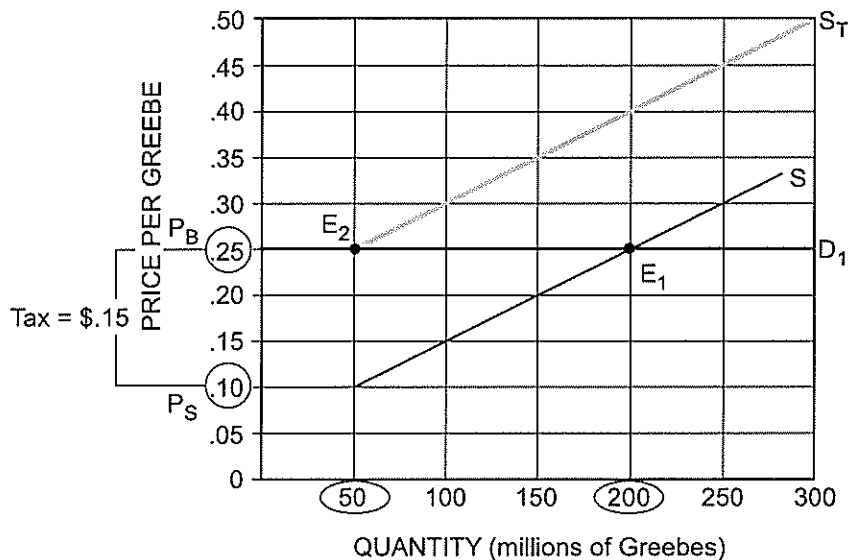
11. On Figure 21.5, the equilibrium quantity of Greebes is 200 million. Q_{E1}
12. On Figure 21.5, the equilibrium price of Greebes is \$0.25 per Greebe. P_{E1}
13. Buyers are spending a total of \$50 million on Greebes. ($\$0.25 \times 200 = \50)
14. Sellers are receiving a total of \$50 million from selling Greebes. ($\$0.25 \times 200 = \50)
15. If an excise tax of \$0.15 for each Greebe sold is levied on the sellers of Greebes, the equilibrium price paid by buyers (P_B) will differ from the equilibrium price received by sellers (P_S) by the amount of the tax. This \$0.15 goes to the government. Add the new supply curve incorporating the tax to the graph, and indicate P_B and P_S . Under these circumstances:
 - (A) The new equilibrium quantity of Greebes would be 200 million. Q_{E2}
 - (B) The new equilibrium price paid by buyers would be \$0.40 per Greebe. ($P_B = P_{E2}$)
 - (C) The new equilibrium price received by sellers (after tax) would be \$0.25 per Greebe.
($P_S = P_B - \text{TAX} = \$0.40 - \$0.15 = \0.25)
 - (D) Buyers would spend a total of \$80 million on Greebes.
($P_B \times 200 = \$0.40 \times 200 = \80)
 - (E) Sellers would receive a total of \$50 million (after tax) from selling Greebes.
($P_S \times 200 = \$0.25 \times 200 = \50)

- (F) The government revenue from this tax would be \$30 million.
($TAX \times 200 = \$0.15 \times 200$)
- (G) \$30 million of this revenue would be paid by buyers in the form of higher prices.
($\$0.40 - \$0.25 \times 200 = \$0.15 \times 200 = \30)
- (H) \$0 million of this revenue would be paid by sellers in the form of reduced income.
($Q_{E1} = Q_{E2}$)
- (I) As a result of the tax, buyers will buy a smaller quantity than before the tax. If so, the sellers would also have a loss of revenue that is not collected by the government. In this case, the *uncollected revenue loss* would be equal to \$0 million. *There is no uncollected revenue loss.*

Part D



Figure 21.6
Perfectly Elastic Demand for Greebes



16. On Figure 21.6, the equilibrium quantity of Greebes is 200 million. Q_{E1}
17. On Figure 21.6, the equilibrium price of Greebes is \$0.25 per Greebe. P_{E1}
18. Buyers are spending a total of \$50 million on Greebes. ($\$0.25 \times 200 = \50)
19. Sellers are receiving a total of \$50 million from selling Greebes. ($\$0.25 \times 200 = \50)

20. If an excise tax of \$0.15 for each Greebe sold is levied on the sellers of Greebes, the equilibrium price paid by buyers (P_B) will differ from the equilibrium price received by sellers (P_S) by the amount of the tax. This \$0.15 goes to the government. Add the new supply curve incorporating the tax to the graph and indicate P_B and P_S . Under these circumstances:
- (A) The new equilibrium quantity of Greebes would be 50 million. Q_{E2}
 - (B) The new equilibrium price paid by buyers would be \$0.25 per Greebe. ($P_B = P_{E2}$)
 - (C) The new equilibrium price received by sellers (after tax) would be \$0.10 per Greebe.
($P_S = P_B - TAX = \$0.25 - \$0.15 = \$0.10$)
 - (D) Buyers would spend a total of \$12.5 million on Greebes.
($P_B \times 50 = \$0.25 \times 50$)
 - (E) Sellers would receive a total of \$5 million (after tax) from selling Greebes.
($P_S \times 50 = \$0.10 \times 50 = \5)
 - (F) The government revenue from this tax would be \$7.5 million.
($\$0.15 \times 50 = \7.5)
 - (G) \$0 million of this revenue would be paid by buyers in the form of higher prices.
($P_B = P_{E1}$ or $P_B - P_{E1} = 0$)
 - (H) \$7.5 million of this revenue would be paid by sellers in the form of reduced income.
($P_{E1} - P_S) \times 50 = (\$0.25 - \$0.10) \times 50 = \$0.15 \times 50 = \$7.5$)
 - (I) As a result of the tax, buyers will buy a smaller quantity than before the tax. If so, the sellers would also have a loss of revenue that is not collected by the government. In this case, the *uncollected revenue loss* would be equal to \$37.5 million.
($200 - 50) \times \$0.25 = 150 \times \$0.25 = \$37.5$ or $\$50$ (4)
 $\begin{array}{r} -5 \text{ (5E)} \\ 45 \\ -7.5 \text{ (5H)} \\ \hline 37.5 \end{array}$

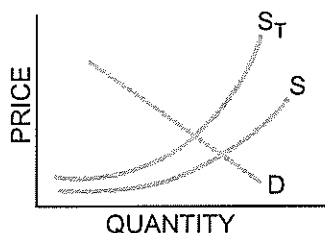
Part E

- 21. A famous Supreme Court justice once said, "The power to tax is the power to destroy" sellers. This is more likely to be true the more the demand for the product taxed is relatively (elastic / *inelastic*). See Part D.
- 22. If you were a government revenue agent interested in getting the most tax revenue possible, you would suggest putting excise taxes on goods whose demand is (*elastic* / *unit elastic* / inelastic). See Part C.
- 23. Think of some real-world goods on which excise taxes are placed: liquor, cigarettes, gasoline. Do you think that the demand for these goods is relatively elastic or relatively inelastic? Why?
Relatively inelastic. No good substitutes for the addicted. Also considerable revenue is collected from these taxes.

Part F

Consider this newspaper quotation and answer the questions that follow: “The city is planning to place a 10 percent tax on auto parking. The tax would fall on every motorist who uses a space in either the garages and the lots operated by the Public Parking Authority or in privately operated lots and garages.”

24. Draw the demand curve and the long-run supply curve for parking lots. Explain why each has the shape you show; in other words, why each is relatively elastic or inelastic.
- The long-run supply curve would not be perfectly inelastic. Additional parking places could be added as prices increased. Existing facilities now used for other things could be converted to parking garages, and additional stories could be added to existing garages if the price increased enough. The elasticity of the total demand curve is the result of the relative elasticity of demand for different groups of downtown parkers and the strength of the substitution effect and the income effect for these groups. Downtown shoppers have more substitutes (for example, suburban shopping malls with free parking) than do downtown office workers, but even office workers could form car pools and / or use public transportation if the price of parking increased sufficiently. The income effect would be larger for office workers who come every day than for occasional shoppers.*



25. Given the curves you have drawn in Question 24, show the effect of introducing a 10 percent tax: How does the equilibrium position after imposition of the tax compare with the initial equilibrium position? *Price would be higher. Number of spaces used would be smaller. See Part C, except a percentage tax would result in S_T getting progressively farther from S compared with Part C, where a tax was a fixed cents-per-unit amount rather than a percentage.*
26. The newspaper quotation implies that the “burden” of the tax will fall entirely upon the driver. Is this true for the case you have developed in Questions 24 and 25 above? Under what circumstances would this be true? *No, there would most likely be some “sharing” of the burden, since neither supply nor demand is perfectly inelastic. The burden would fall entirely upon the driver if demand were perfectly inelastic. See Part A.*